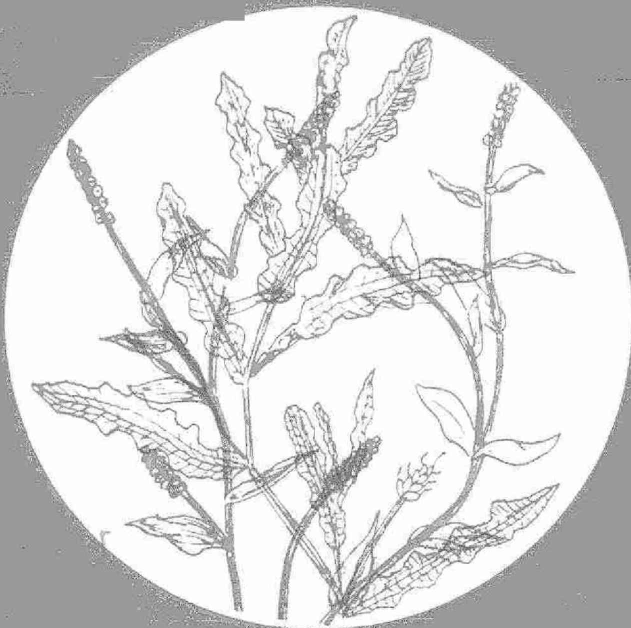
AQUATIC PLANT and ALGA[illegible]TROL



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Ontario

1980

Hon. Harry C. Parrott, D.D.S.,
Minister

Graham W. S. Scott, Q.C.,
Deputy Minister

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INTRODUCTION

Aquatic plants and algae in a variety of forms are a natural integral part of a healthy aquatic ecosystem. They will grow wherever suitable sunlight, nutrients, appropriate substrate, and water quality conditions exist. As different plant species have different requirements in this regard, where these parameters vary a variety of ecological niches is produced and a natural mixture of plants will co-exist.

Aquatic plants are beneficial. They augment natural dissolved oxygen levels, bind available plant nutrients and provide food and habitat for 300 plantation and other invertebrates. They provide protective cover for fish from their predators, and camouflage nesting sites. In addition, the seeds and tubers provide a source of food for water-fowl, and the foliage serves as shelter for amphibians, waterfowl and muskrats.

In excessive amounts, however, aquatic vegetation can have a detrimental effect on the ecosystem. Algal blooms or dense submerged plant communities can create large daily oscillations in the dissolved oxygen levels in the water such that fish may die. Furthermore, excessive plant cover can result in severly stunted fish populations. In many recreational lakes in Ontario, dense stands of aquatic plants such as Eurasian water milfoil *Myriophyllum spicatum* pose a major deterrent to recreational usage, particularly for activities such as swimming, boating, water skiing.

CLASSIFICATION OF PLANTS

1. Algae

The simplest form of plant that lives in a water environment is the unicellular plant or alga. These included forms such as silica-shelled diatom and *Euglena* sp. Here, each cell is a complete plant in itself. Rapid increases in numbers occurs by the division of each cell assuming that nutrients phosphorus and nitrogen are available. These maybe introduced into the water naturally (through the decomposition of grass clippings, leaf matter, or large aquatic plants) or artificially (for example, the leakage of a faulty septic system, or the run-off and seepage from farm livestock operations).

Filamentous algae, on the other hand, consist of a series of cells joined end to end. As with the previous groups, these must be examined under a microscope for accurate identification. Common species of filamentous green algae such as *Spirogyra* sp., *Mougeotia* sp., and *Ulothrix* sp. Sometimes occur in large amounts in fish, farm and golf course ponds early in the spring, but may die back naturally when the surface water temperature exceeds species tolerance. After an algicide application, the duration of control of nuisance filamentous algae varies with pond flushing rates and the potential for re-invasion from upstream sources. *Cladophora* sp., a branched filamentous green alga, is very much a problem in many beach areas of the Great Lakes, such as Lake Huron, Lake Erie and Lake Ontario, where plant filaments growing attached to rocks underwater, often quite a distance from shore, are broken off and washed up on the beaches; decomposing debris often causes obnoxious odour problems.

Aside from greens, blue-green algae, both unicellular (*Microcystis* sp.) and filamentous (*Aphanizomenon* sp., *Lyngbya* sp. and *Anabaena* sp.) may also develop into nuisance "blooms" where suitable

conditions occur. Microcystis sp. has been known to exist in such high concentrations, as to cause death of cattle when contaminated water was used for livestock watering. This was due to an abnormally high concentration of the toxins which are secreted naturally by these cells perhaps to inhibit establishment of competitive algal species.

One family of filamentous algae often mistaken for vascular submergent plants includes the muskgrass Chara spp. and stoneworts Nitella spp. In these plants the cells incorporate calcium carbonate from the water into the cell wall to give it rigidity. There is sufficient calcium carbonate that, when the plants are removed from the water and dried, a white powder is left. Chara is a problem in many hard-water trout ponds where it can grow, when unchecked, up to ten or twelve feet in length. Since it does not have a true vascular system and each filament fragment can regenerate a new plant, systemic herbicides, often mistakenly selected for use, do not work. Re-invasion, following fragmentation during mechanical removal, can be a problem.

SUBMERGENTS

The second main category of aquatic vegetation, submergent plants, include those which grow entirely below the surface of the water, with modified floating leaves on the water surface and flower spikes and seedheads most often above the water surface. In many lakes in the Kawartha-Trent system and the Rideau Lakes-Canal system, a community of mixed species is common: Water naiad Najas flexilis narrow-leaf pondweeds, including Sago pondweed Potomageton pectinatus, bassweek P. amplifolius, Richardson's pondweed P. richardsonii, Curly-leaf pondweed P. crispus, Canada water weed Elodea canadensis, coontail Ceratophyllum demersum, Water milfoil Myriophyllum spp. and tape grass Vallisneria americana. Where in the past, susceptible species of submergents have been treated with herbicides, dominance in the plant community has shifted towards tape grass.

EMERGENTS

Emergent plants, the third main category of aquatic vegetation, include those plants which grow on, or to a significant extent above the water surface. Duckweed Lemna minor and L. trisulca is often a problem in permanent water swamps and drainage ditches where water flow is minimal or non-existent.

Emergent vegetation in roadside ditches, and in undeveloped areas around the edges of lakes and rivers, include such families as: bulrushes Scirpus sp., arrowhead Sagittaria sp., pickerelweed Pontederia sp., water plantain Alisma sp., White water lily Nymphaea sp., yellow water lily Nuphar sp., and cattails Typha sp. Best management can be achieved by integrating herbicide application with habitat alteration (e.g. dredging) to prevent re-invasion.

For all the above plant categories, water level fluctuations and seasonal variation in weather pattern as well as winter severity will cause a change in community species and density over time. It is, therefore, best to assume that in growth future years cannot be predicted 100% and instead to watch for changes from year to year.

EURASIAN WATER MILFOIL

Myriophyllum spicatum

Many of today's problems in environmental management relate directly to the

presence of exotic imports. These are non-native plants or animals which have been introduced intentionally or accidentally by man.

In Canada, the best known aquatic invader is Eurasian water milfoil. This native of Europe and Asia was first found in 1902 in Chesapeake Bay, Maryland and has since spread throughtout North America. It's first record in Canada is a now preserved, specimen collected from Rondeau Bay Provincial Park in 1961. The plant was not widely recognized as a nuisance until the early 1970's when it became troublesome in the Kawartha Lakes, Ontario, in Quebec and in British Columbia.

Eurasian water milfoil is an extremely aggressive plant which reproduces largely by auto-fragmentation and soon crowds out the native plants. It can invade water from 1 to 10 metres deep. When the stems reach the surface, canopy formation occurs through profuse branching at the water surface. In temperate climates the plant exhibits a rapid growth phase in early spring, generally reaching the water surface by mid to late June and thus creating severe interference with recreational use. Since it can thrive under a variety of environmental conditions, it is now widespread in Ontario, except in the soft-water Precambrian Shield Lakes.

PLANT IDENTIFICATION

As with any pest, it is imperative that the problem is properly identified before a control method is selected. Any information about the life history of the plant, methods of reproduction and dispersal also assists in defining the techniques that would be most effective in obtaining long-term control. The diagrams and plant descriptions on pages 12 – 20 illustrate some of the more common species of aquatic vegetation in Ontario. If you have any doubts about the identity of your pest plants, package samples of each kind in a little water in separate plastic bags to prevent them drying out and mail them to the Ministry of Environment, Pesticides Control Section, Suite 100, 135 St. Clair Avenue West, Toronto, M4V 1P5. Alternatively, bring them to 40 St. Clair Avenue West, 7th Floor, Toronto, or to your nearest Regional or District Office of the Ministry (see list on page 11).

CONTROL METHOD

There is no one simple answer to aquatic vegetation control. When considering weed control measures for lakes where aquatic plants interfere with recreational use, primary consideration should obviously be given to rectifying the main causes of the problem, i.e. reducing the amount of nutrient entering the water. However, weed distribution in many lakes contain very large amounts of nutrients in the bottom sediments available for future generations, without a substantial increase from elsewhere. Thus, control becomes largely cosmetic, where excessive amounts of growth are suppressed but where plants are NOT permanently eliminated. A wide range of control measures including habitat manipulation, biological control, mechanical harvesting and chemical control have been practised around the world with variable success. A careful assessment of various usages, and the relative values of the presence or absence of aquatic plants in a particular situation, should be made before any attempt at control is undertaken.

\. HABITAT MANIPULATION TECHNIQUES

The objective of habitat manipulation is to alter one or more of the physical or chemical factors critical to plant growth. Examples of these techniques include the use of dyes in the water column, or floating sheets of black plastic or other screening material on the water surface, to reduce light penetration. Blanketing or covering of the lake bottom with 15 to 20 cm of sand is an effective method of physically altering the substrate. A sheet of dark heavy-duty construction polyethylene placed below the sand blanket will have the effects of both curtailing the transport of nutrients from the lake bottom, and preventing the sand from sinking into soft sediments. Dredging can be used to deepen a body of water and thus reduce the areas which can be colonized by plants. It can also remove nutrient-rich sediments and alter the texture of the substrate, particularly in areas where sitting has covered sterile sand or gravel bottoms. While deep dredging appears to be an effective long-term control, it is prohibitively costly. A less costly method which has been used with variable success is overwinter draw-down. This technique consists of lowering the water levels to expose the plants to freezing and desiccation. It's use for Eurasian Water milfoil control in the Kawartha Lakes has been reviewed in detail but found to be of questionable value due to:

a) The small amplitude (about 4');

b) The predominance of mixed plant communities in the shall nearshore areas of the lakes. These communities are largely comprised of annual plants which are resistant to this form of control;

c) The possibility of causing severe oxygen depletion with resultant fish kills during the winter months because of the shallow nature of the lakes.

BIOLOGICAL CONTROL METHODS

These involve the use of a biological agent to control an undersirable pest species. Such biological control is viewed by its proponents as an inexpensive alternative to the often costly methods of chemical or mechanical control. However, since these biological agents (fish, pathogens, insects) are by necessity exotic imports, and in view of our past serious mistakes, there is a general reluctance to use these techniques on a wholesale basis.

One of the most publicized biological control agents for aquatic vegetation is the Grass carp Ctenophyaryngodon idella. This fish was first imported to Arkansas in the early 1960's for research purposes. Due to carelessness, the fish escaped from captivity and has spread to several major river systems in the U.S.A. At this time, there is still considerable disagreement over the beneficial aspects of Grass carp and further importation has now been banned. Of major concern is the fact that, if the carp spawns in large numbers in North America, the possibility of massive destruction of aquatic vegetation could bring disaster to native fishes, invertebrates and waterfowl. Native species of the carp family, namely the European carp and goldfish affect vegetation by uprooting plants while feeding on invertebrates in the detritus and by creating turbid water conditions through which sunlight cannot penetrate for plant photosynthesis. They are not herbivores in the true sense and aggressively compete with trout and bass populations often to the point of elimi-

nating these latter species. Waterfowl, including ducks and geese, may have beneficial effects in reducing the plant population; however, their droppings are messy, and if they fall into the water they fertilize it to such an extent that algal population explosions may occur.

Plant pathogens represent another area which is being explored for potential biocontrol agents. It has been estimated that there are over 100,000 plant diseases, thus offering untapped reservoirs of viruses, bacteria, fungi, etc. as potential control agents. Certain invertibrates, such as the aquatic snail Marisa cornuarietis, also hold some promise as biocontrol agents, but could become pests themselves since they are non-specific and could destroy beneficial plants. One insect species, the alligatorweed flea beetle Agasicles hygrophila holds much promise since it is specific to alligatorweed, a problem plant in the southern U.S.A.

Obviously, the use of biocontrol agents is still in its infancy and must be approached with caution to avoid the possibility of substituting one pest by another.

MECHANICAL CONTROL

Mechanical removal of nuisance vegetation represents one of the oldest techniques known to man. Equipment can range from chains dragged along the bottom to uproot vegetation, to small inexpensive boat-mounted cutters, or large sophisticated machines capable of cutting and collecting the plants for shoreline disposal. The use of mechanical methods for clearance of small areas (e.g. swimming beaches) is rather impractical since the use of small cutters or chains requires intensive manual labour to remove the vegetation from the water. Failure to remove the uprooted plants or cuttings could create oxygen depletion problems through decomposition of the vegetation or encourage the spreading and re-rooting of plant fragments.

On the other hand, for large scale projects which use the larger automated machines, mechanical harvesting has been advocated as an environmentally sound approach. Vast quantities of plant material containing nutrients (e.g. nitrogen and phosphorus) can be removed from the waterways without significantly affecting the fisheries or the food web that the fish depend on.

For additional information on harvesting techniques and equipment manufacturers contact the Water Resources Branch, Limnology and Toxicity Section, Box 213, Rexdale, M9W 5L1 (416-248-3058).

CHEMICAL CONTROL

Chemical control, largely using herbicides developed for terrestrial weed control, has been a commonly used tool throughout North America for several decades. Since the mode of action of herbicide may be contact or systemic, plant susceptibility varies according to the nature of its growth and reproduction. There is, therefore, some degree of selectivity in herbicides which may be used in the aquatic environment, and the nature and extent of plant nuisance must be defined before any treatment can be utilized safely and effectively. Since herbicides destroy the way in which basic nutrients are bound up in plant form, rather than cause a reduction of nutrients in the aquatic environment, herbicide usage may cause a release of nutrients following macrophyte decomposition, with consequent severe algal "blooms". On the whole, herbicides are best used for weed control

in small plots where such pronounced secondary effects will not occur.

In Ontario, a permit system restricts excessive and indiscriminate use of herbicides. Herbicides that are authorized for use have been stringently tested for safety and efficacy, and must be specifically registered for aquatic use under the Pest Control Products Act by Agriculture Canada. Since information recommendations on aquatic herbicide usage are obtained and followed. The Pesticides Control Section in Toronto or the Regional Offices of the Ministry of the Environment (see page 11) distribute copies of the Guide to Chemical Weed Control (Ontario Ministry of Agriculture and Food, publication #75), which is revised annually. Small cottage frontages and farm ponds comprise the bulk of herbicide uses; large scale programmes are discouraged in the light of significant negative environmental impact and lack of financial subsidy.

Not all species of aquatic vegetation in lakes can be controlled by currently registered herbicides. Muskgrass Chara spp. tape grass Vallisneria americana and the filmentous green algae Cladaphora spp. are three examples of plants in lakes that are resistant to herbicidal activity, by reason of their physiology or their location in the lake. When resistant and susceptible plant species combine to create a problem, an integrated management scheme must be sought, rather than one utilizing solely pesticides.

PESTICIDES LEGISLATION

The Pesticides Act, 1973 Subsection 1 of Section 4 provides that no person shall engage in, perform or offer to perform a (water) extermination except under or in accordance with a licence of a prescribed class . . . Unless exempt under the regulations. In essence, a water extermination licence (Class 1 or Class 3 endorsed) is required by anyone applying a pesticide to water for algae or aquatic plant control other than on his own domestic premises.

In addition, Subsection 6 of Section 6 provides that anyone performing a water extermination must be the holder of a permit issued by the Director (under the Act) unless exempt under the regulations. Thus, a person requires a permit for the use of an aquatic herbicide where the treated water will move from the site of application to a lake, stream or other public water course by any means other than by percolation through the soil. Any aquatic herbicide research conducted in Ontario, regardless of trail location, requires a permit.

For example, a cottage association proposing to control submergent aquatics in a bay or lake area fronting numerous cottages will require a licence and a permit. One cottager treating his own cottage frontage will require only a permit. A municipality treating drainage ditches for control of emergent vegetation in the fall when the ditches contain no moving water will require only a licence.

Further information concerning licence applications, training sessions and examination requirements can be obtained from the Pesticides Control Section, 135 St. Clair Avenue West, Toronto, or the Regional or District pesticides specialist (see list on page 11). The licencing system has the effect of consenting people on the safe storage, handling, and use of a pesticide, and the impact of the chemical on the aquatic environment.

An aquatic nuisance control permit is issued for one year only and ensures that there will be no unreasonable infringements on the rights of other water users.

It also makes certain that the substance applied will not be toxic to humans, fish, domestic animals, or wildlife. Through the permit system, the area of vegetation treated in any one lake is regulated so that important fisheries and other wildlife habitat will not be significantly affected. To obtain a permit for applying a chemical or other substances to control nuisance conditions in any area of water, an individual or commercial agency must submit pertinent information on an official application form, so that the nature of a project and possible consequences arising from it can be satisfactorily evaluated. These application forms may be obtained by writing the Ministry of the Environment, Pesticides Control Section, Suite 100, 135 St. Clair Avenue West, Toronto, Ontario, M4V 1P5, or to Regional or District Offices of the Ministry (see page 11).

An application should be submitted well in advance of the time that the chemical is to be applied. While every effort is made to process applications as quickly as possible, three weeks may be required for the issuance of a permit, since it is necessary to correspond with the appropriate District Office of the Ministry of Natural Resources concerning a proposed treatment, or actually to investigate the area.

The acquisition of a permit or a licence does not divest any individual or commercial applicator from the responsibility for any undesirable consequences arising from a treatment. Anyone applying any substance without the authority of a licence or permit, or who violates the terms and conditions provided in a permit, is guilty of an offence under the Pesticides Act, 1973 and Regulations, and upon a summary conviction is liable to a fine.

All aquatic nuisance control permit applications are reviewed by the Ministry of the Environment regional pesticides officers and water resources staff and the local Ministry of Natural Resources fisheries biologist. If valid scientific reasons exist the Director may deny the permit, or impose conditions. The permittee may appeal by contacting the Director and a hearing will be organized with the Pesticides Appeal Board.

Since 1978, purchase of an aquatic herbicide for public water treatment cannot be made without prior receipt of a valid aquatic nuisance control permit. This tightening up of the availability of aquatic herbicides has served to eliminate those individuals who were previously indiscriminately using herbicides without proper authorization or at excessive rates. The general concept of "the more the pesticide the more effective the control" is NOT an environmentally safe use practice.

HERBICIDE CALCULATIONS

Herbicides are found in a variety of formulations: wettable powders, granules, emulsifiable concentrates, and suspensions. Any package of product purchased from a retail outlet contains filler as well as the active ingredient (technical material). Thus, in the case of Simmaprim 80W, 80% or 8 out of any 10 pounds of product will be the active simazine; in the case of Reglone L 20% w/v or two pounds of active diquat is contained in one Imperial gallon of product.

In all cases, the label should be consulted for effective registered rates. The pesticide may be applied on an area basis (usually so much per acre), OR on a volume basis (usually so much per acrefoot). One acrefoot is an area of one acre having an AVERAGE depth of one foot OR an area of onehalf acre having an AVERAGE

depth of two feet. IT IS IMPERATIVE THAT ACCURATE MEASUREMENTS OF WATER VOLUME are made so that the correct amount of pesticide is applied.

By 1981, pesticides in Canada will have metric labels. Calculations may appear to be difficult and confusing; if in doubt, contact the Ministry.

Aquatic nuisance control permit applications and other information regarding herbicides used for aquatic vegetation control can be obtained through the regional offices, Ministry of Natural Resources, the Pesticides Control Section, Ministry of Environment, Toronto, (416-965-2401), or the Regional or District Offices of the Ministry of the Environment (see page 11).

CONCLUSION

The field of aquatic plant management is a complex one. Control is the selection of a suitable tool from a list of potential options whilst avoiding all obvious pitfalls. For any given problem situation, no single control method is without drawbacks and an integrated 'balanced' approach will often provide the best possible solution.

CAUTION:

When using aquatic herbicides, please be sure to read the label carefully.

ONTARIO MINISTRY OF THE ENVIRONMENT
PESTICIDES CONTROL FIELD OFFICES

COUNTY	DISTRICT	TELEPHONE
Essex, Kent, Lambton	H. E. Collins P.O. Box 237, 435 Grand Ave. W. Chatham, N7M 5K3	519-352-5107
Elgin, Middlesex, Oxford	D.C. Morrow & W. Lampman 985 Adelaide Street South London, N6E 1V3	519-681-3600
Brant, Haldimand, Norfold	J. Percy 645 Norfolk St. N. Simcoe, N3Y 3R2	519-426-1940
Niagara, Hamilton, Wentworth	Centennial Plaza 140 Centennial Pkwy. N. Stoney Creek, L8E 1H9	416-561-7412
Dufferin, Wellington, Waterloo	R. Miller P.O. Box 219, Clyde Road Cambridge (Galt), N1R 5W6	519-623-2080
Bruce, Grey, Huron, Perth	B.T. Lobb P.O. Box 688 Ont. Ministry of Agr. & Food Bldg. Clinton, N0M 1L0	519-482-3428
Simcoe, Muckoka	W. Cowie 12 Fairview Road Barrie, L4N 4P3	705-726-1730
Halton, Peel, York, Durham, Toronto	T. O'Neill & D. Trenholm 150 Ferrand Drive, Suite 700 Don Mills, M3C 1H6	416-424-3000 (Ext. 204)
Peterborough, Victoria Haliburton, Northumberland	A.G. Carpentier 139 George Street Peterborough, K9J 3G7	705-743-2972
Frontenac, Lanark, Hastings, Lennox & Addington, Prince Edward, Leeds & Grenville	D.A. Raddon 15 Victoria Avenue Belleville, K8N 1Z6	613-962-9208
Prescott & Russell, Renfrew Stormont, Dundas & Glengarry, Ottawa-Carleton	R.P. Cameron 2378 Holly Lane, Suite 204 Ottawa, K1V 7P1	613-521-3450
Algoma, Manitoulin, Nipissing, Parry Sound, Sudbury	D.J. Mewett Northgate Shopping Centre 1500 Fisher Street North Bay, P1B 2H3	705-476-1001
Cochrane, Timiskaming	P. McCubbin 83 Algonquin Blvd. West Timmins, P4N 4R4	705-264-9474
Kenora, Rainy River, Thunder Bay	G.R. Gammond Ontario Government Building 435 James Street South Thunder Bay "F", P7E 6E3	807-475-1305
	Pesticides Control Section Head Office 135 St. Clair Avenue West Toronto, Ontario, M4V 1M2	416-965-2401

FILAMENTOUS ALGAE

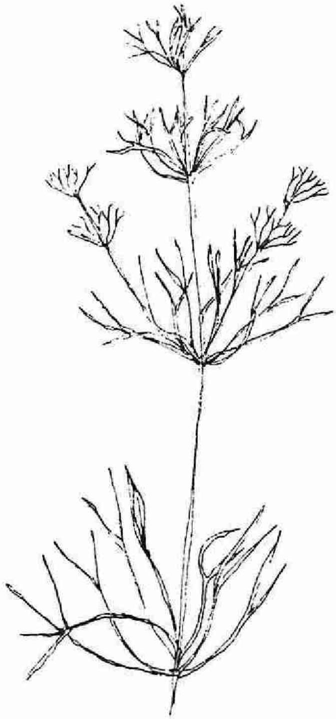
PLANT-LIKE ALGAE

MUSKGRASS

Chara vulgaris

½ - 1 x actual size

- lime green - grey green
- rough, coarse, gritty to the touch
- strong musk odour
- dries to white powder when removed from water
- attached to the bottom
- usually less than 2 feet high
- orange fruiting bodies may be present

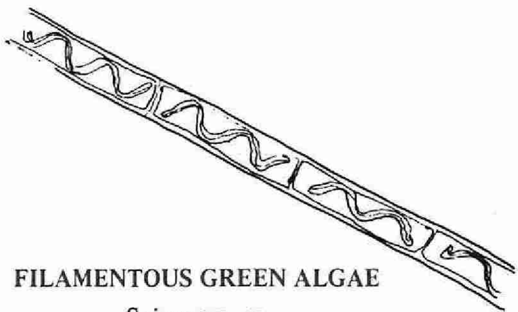


STONEWORT

Nitella sp.

3 x actual size

- much like Chara but smooth to the touch



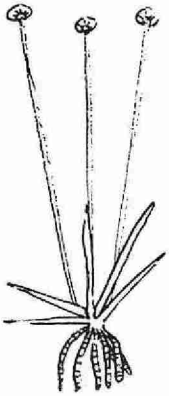
FILAMENTOUS GREEN ALGAE

Spirogyra sp.

125 - 250 x actual size

- green hair-like filaments
- slimy to touch
- often attached to rocks

SUBMERGED VASCULAR AQUATIC PLANTS

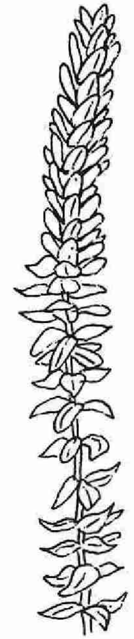


PIPEWORT

Eriocaulon sp.

½ x actual size

- leaf rosette about 3" diameter
- button-like white flowers on straight stalk above surface of water
- fibrous white root



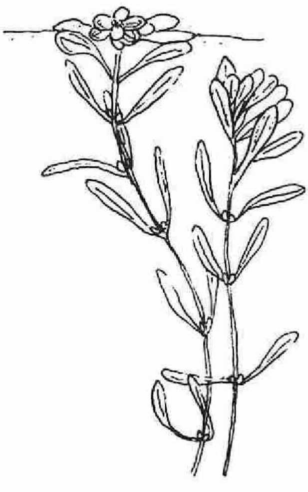
CANADA WATER WEED

Ancharis canadensis

(ELODEA)

actual size

- entirely submerged except in flower
- stem often branched
- base of leaf embraces stem
- clusters of 4 small leaves around main stem
- leaf margin has microscopic teeth

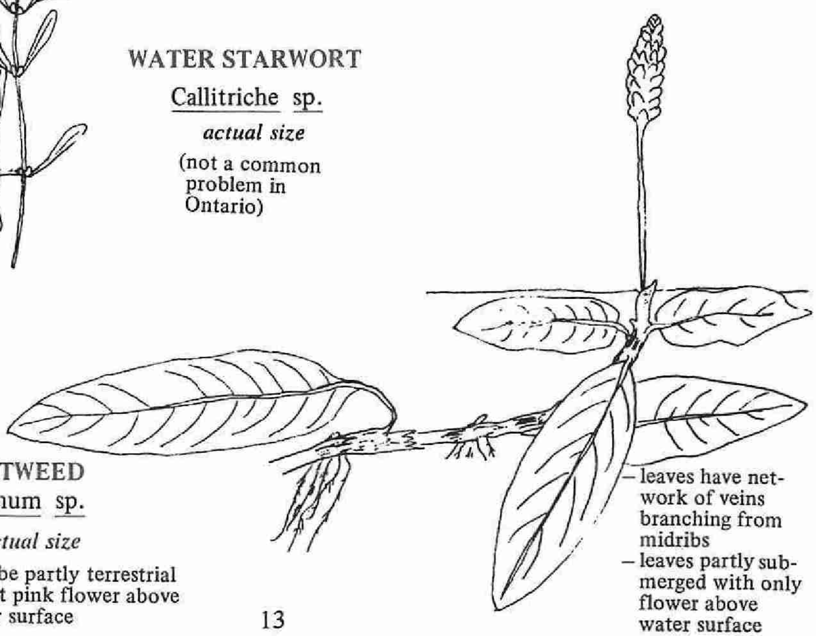


WATER STARWORT

Callitriche sp.

actual size

(not a common problem in Ontario)



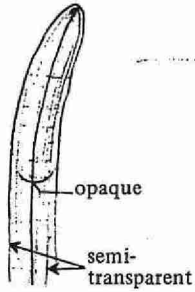
SMARTWEED

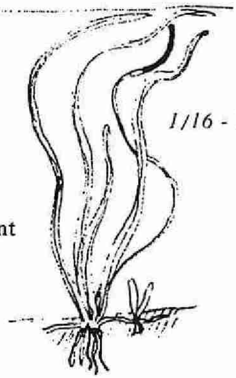
Polygonum sp.

½ x actual size

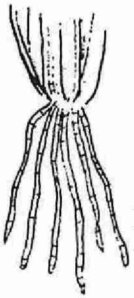
- may be partly terrestrial
- bright pink flower above water surface

- leaves have network of veins branching from midribs
- leaves partly submerged with only flower above water surface





1/16 - 1/4 x actual size



actual size

TAPE GRASS (WILD CELERY)

Vallisneria americana

- leaves ribbon-like, up to several feet in length
- short flared root
- tiny white flower at surface on coiled stem
- long pod-shaped fruiting body
- new plants grow at nodes along buried stems

WATER MILFOIL

Myriophyllum sp.

actual size

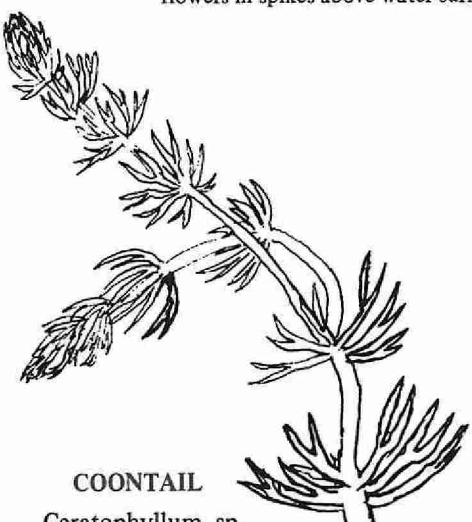
- four leaves at each stem node
- each leaf symmetrically subdivided
- many stems from 1 root; stems may be branching
- there are a number of native and exotic species
- flowers in spikes above water surface

BLADDERWORT

Utricularia vulgaris

actual size

- asymmetrical branching
- tiny bladders easily recognizable



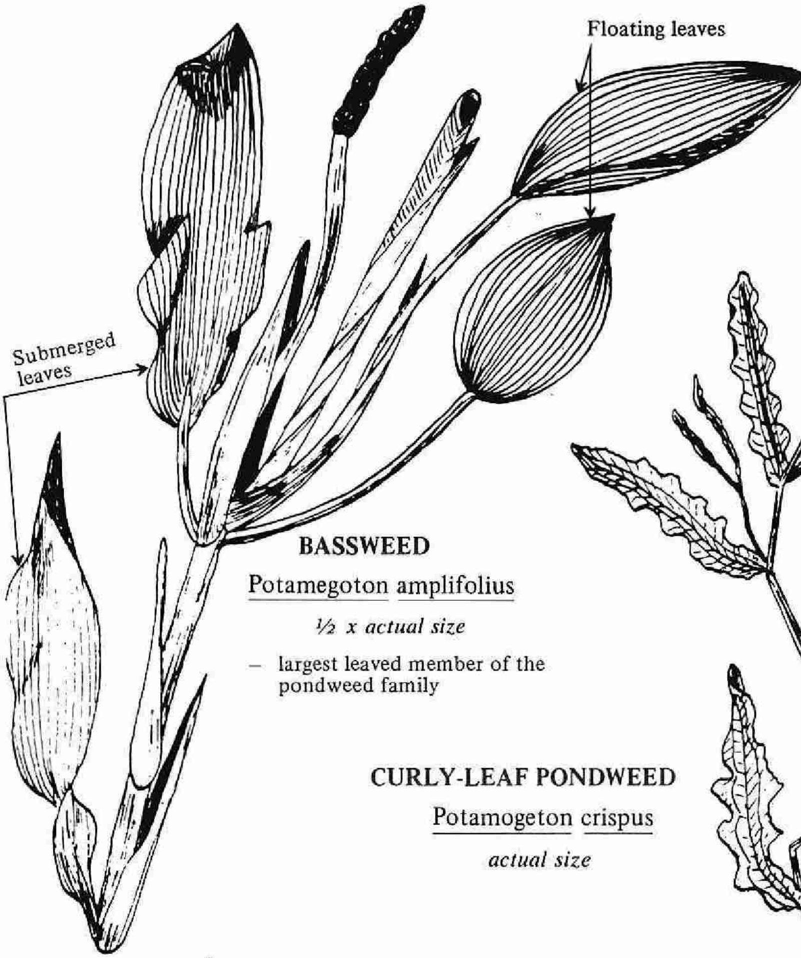
COONTAIL

Ceratophyllum sp.

3/2 actual size

- plants entirely submerged, no roots
- paired leaflets grouped at regular intervals along stem
- stem may be branched

SUBMERGED VASCULAR AQUATIC PLANTS



BASSWEED

Potamegoton amplifolius

½ x actual size

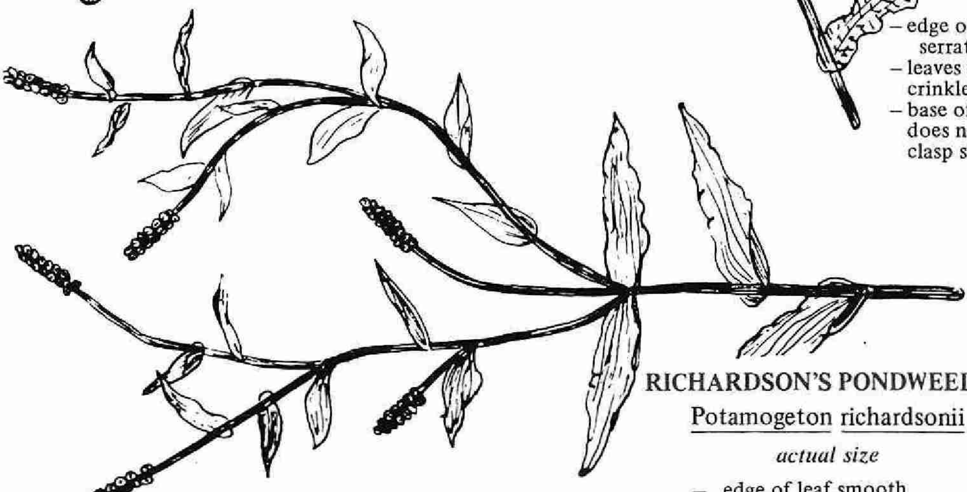
- largest leaved member of the pondweed family

CURLY-LEAF PONDWEED

Potamogeton crispus

actual size

- edge of leaf serrated
- leaves strongly crinkled
- base of leaf does not clasp stem



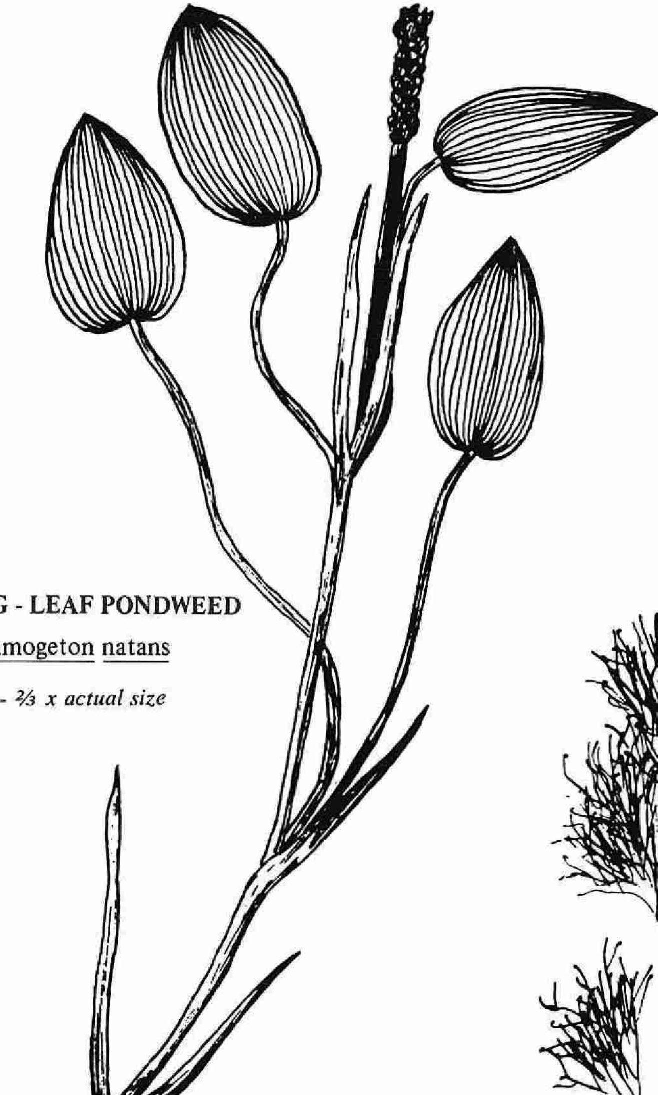
RICHARDSON'S PONDWEED

Potamogeton richardsonii

actual size

- edge of leaf smooth
- leaves moderately crinkled
- base of leaf clasps stem

SUBMERGED VASCULAR AQUATIC PLANTS

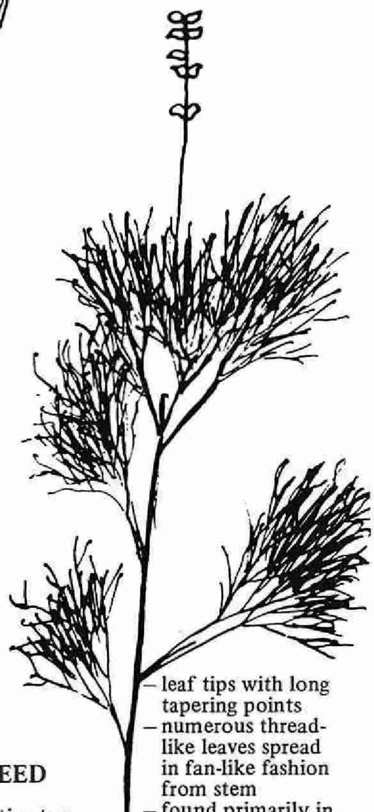


FLOATING - LEAF PONDWEED

Potamogeton natans

½ - ⅔ x actual size

- brownish-green leaves float on water surface
- leaves heart-shaped at base
- flower spike above water surface



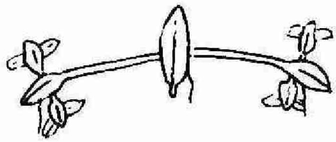
SAGO PONDWEED

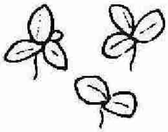
Potamogeton pectinatus

½ x actual size

- leaf tips with long tapering points
- numerous thread-like leaves spread in fan-like fashion from stem
- found primarily in hard or brackish water or slow moving streams

EMERGENT AQUATIC PLANTS





DUCKWEED

Lemna sp.

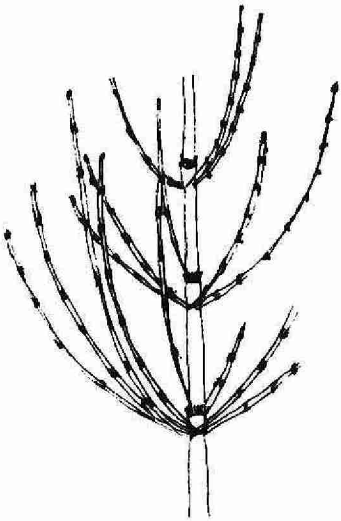
3 - 4 x actual size

- floats at or near surface of water
- hair-like roots may dangle below foliage

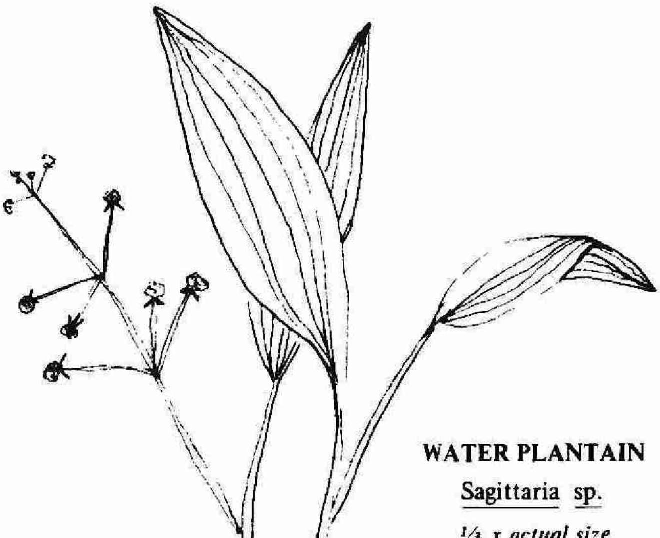
HORSETAIL

Equisetum sp.

½ x actual size



- stems hollow and pointed
- no true leaves but a whorl of slender branches from each joint



WATER PLANTAIN

Sagittaria sp.

⅓ x actual size

- leaves with broad flat blades, tapered at base
- likes moist soil terrestrial habitat

WATERMEAL

Wolffia sp.

4 x actual size

- floating on or near surface of water
- no roots
- microscopic meal-like (globular) bodies

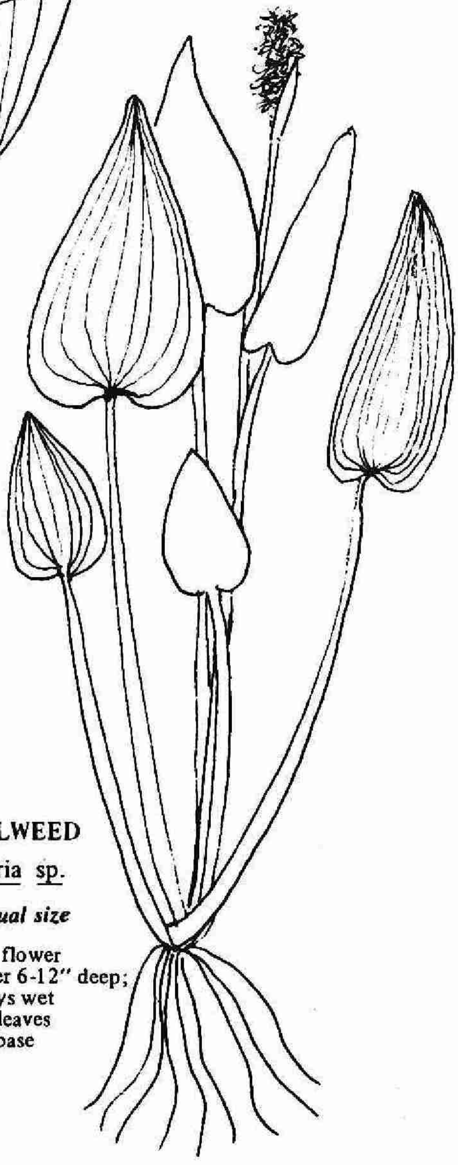
EMERGENT AQUATIC PLANTS

ARROWHEAD

Sagittaria latifolia

⅓ - 1 x actual size

- arrowhead shaped leaves
- tiny white flowers
- likes moist terrestrial environment edging lakes and marshes



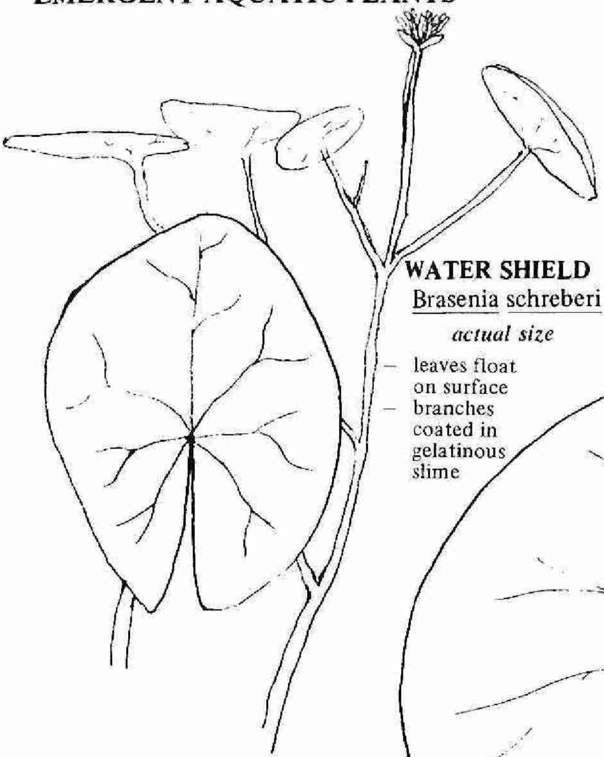
PICKERELWEED

Pontederia sp.

1/4 x actual size

- bright purple flower
- found in water 6-12" deep; must be always wet
- heart-shaped leaves extend from base

EMERGENT AQUATIC PLANTS

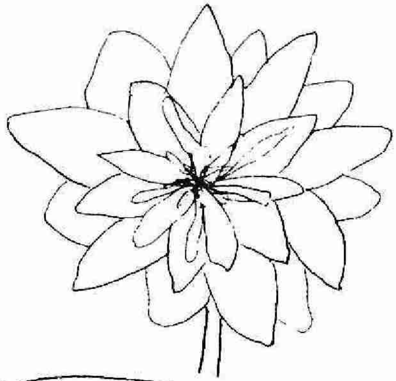


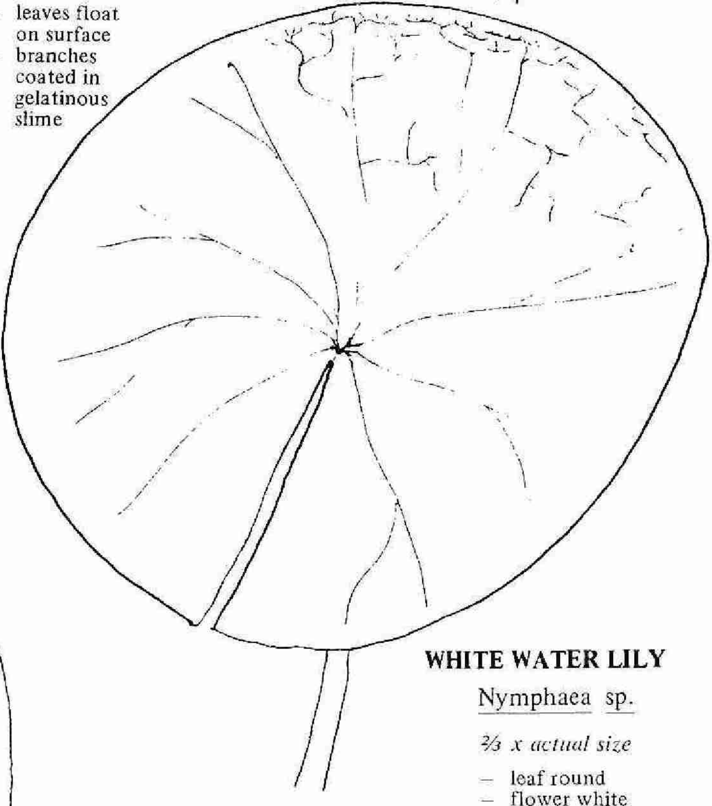
WATER SHIELD

Brasenia schreberi

actual size

- leaves float on surface
- branches coated in gelatinous slime



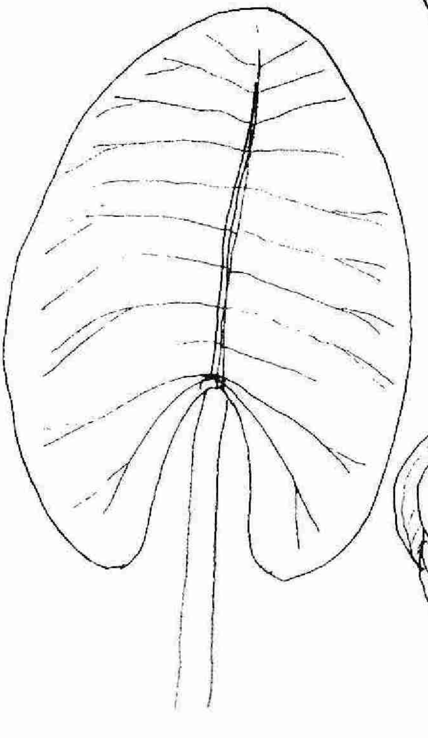


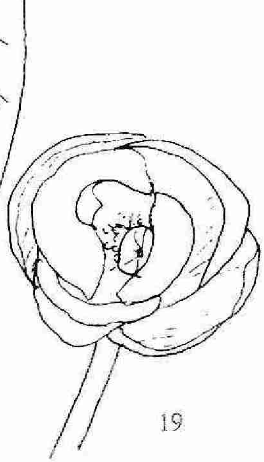
WHITE WATER LILY

Nymphaea sp.

⅔ x actual size

- leaf round
- flower white





YELLOW WATER LILY OR SPATTERDOCK

Nuphar sp.

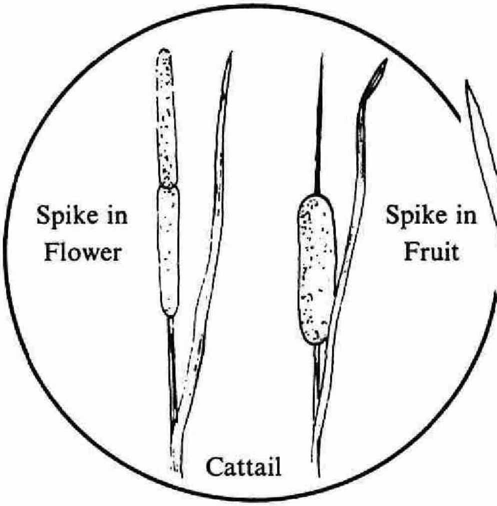
½ x actual size

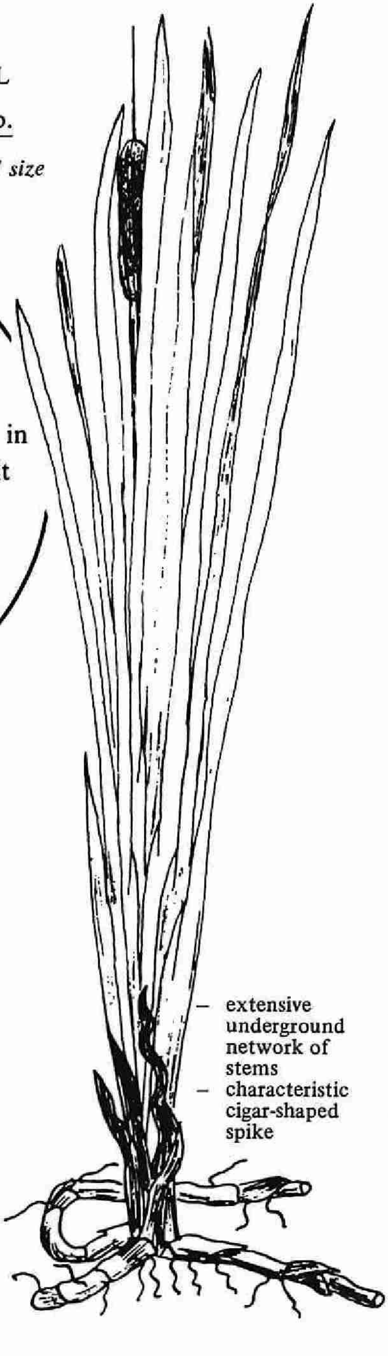
- leaf oblong
- flower yellow

CATTAIL

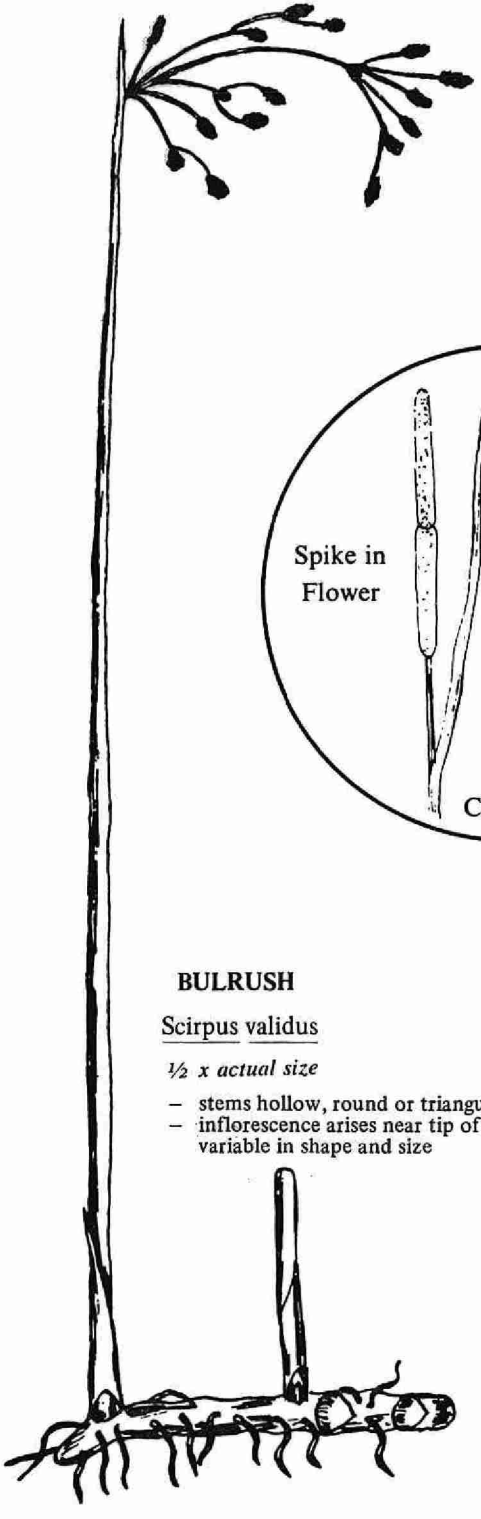
Typha sp.

1/5 x actual size





- extensive underground network of stems
- characteristic cigar-shaped spike



BULRUSH

Scirpus validus

½ x actual size

- stems hollow, round or triangular
- inflorescence arises near tip of stem, variable in shape and size

Date Due

For current information on Aquatic Plant & Algae Control please contact:

Ontario

Ministry of the Environment

Pesticides Control Section

135 St. Clair Avenue West

Toronto Ontario

M4V 1P5

Tel. (416) 965-2401